

## REFERENCES.

- (1) Wallis, B. C. Geographical aspects of climatological investigations. *Scott. geogr. mag.*, Edinburgh, July, 1914, 30: 356-369.
- (2) Wallis, B. C. The rainfall régime of Australia. *Scott. geogr. mag.*, Edinburgh, Oct., 1914, 30: 527-532.
- (3) Wallis, B. C. The rainfall of the southern Pennines. *Quarterly jour., Royal metl. soc.*, London, October, 1914, 40: 311-326.
- (4) Discussion of (3) above, pp. 323-325.

"MONSOON" RAINFALL.<sup>1</sup>

By B. C. WALLIS, North Finchley, England.

The total volume of the precipitation in certain parts of India is apparently so extraordinary that it has caught the special attention of geographers and teachers, and the term "monsoon" rainfall has tended to imply a very special type of rainfall which is intimately related to the southwest monsoon wind. Later investigations demonstrated the fact that the Abyssinian rainfall which caused the Nile flood was sufficiently similar to the Indian rainfall to be called "monsoon" rainfall. The summer rainfall in Abyssinia \* \* \* [has an intensity of 300 per cent] agreeing with a general high rainfall intensity which is reached by those places which have vertical sunshine when the sun is, as it were, journeying southward from the Tropic of Cancer. The rainfall intensity lags behind the sun, so that at a certain place south of lat. 23½°N. the maximum intensity which has been following the sun northward is reinforced by the sun's second passage through the zenith. A precisely similar phenomenon is to be noted in the Southern Hemisphere just north of the Tropic of Capricorn.

Now the pluviometric coefficients for Indian rainfall tend to show precisely the same magnitude of rainfall intensity during the same months as in northern Africa. A rough glance at the monthly and annual rainfall maps of the world in [Bartholomew's] Atlas of Meteorology shows a similar rainfall intensity in northern Australia—where the term "monsoon" rains is used—and also in the belts of similar latitude in South America.

Hence it follows that the maps [published in the original whence this is excerpted] lay bare one of the factors in connection with monsoon rains in India; the incidence of rainfall intensity [as expressed by Angot's "pluviometric coefficients"] is a question of latitude and is a world phenomenon, not a purely local Indian fact. "Monsoon" rainfall, as the name of a phenomenon which is most typically exemplified in India, refers entirely, when regarded in relation to the southwest monsoon, to the *quantity* of the rainfall and not to its incidence during the summer months. Quantity of precipitation appears, therefore, to be a matter of *local* importance due to elevation, prevailing winds, and nearness to the sea as well as to the average temperature of the air.

*Eastern Asia and eastern America.*—It is usual to extend the term "monsoon rainfall" to include the summer rains of northern China and southern Japan. A similar investigation to that of the preceding paragraph indicates that the summer rains of these portions of eastern Asia resemble in incidence of intensity, but not in total quantity, the rainfall which is characteristic in areas of similar latitude to the northeast of the United States.

Here, again, the term "monsoon" is applicable to quantities of rain which coincide in period with the on-shore winds of the monsoon; and this fact is related to

the special nature of the temperature changes to which reference has been made in the first section of this paper.<sup>2</sup>

*Summer savanna rainfall.*—Summer savanna rainfall in the Sudan and Rhodesia is \* \* \* almost entirely a question of (a) a small total annual precipitation and (b) a high summer rainfall intensity which is a question of latitude in relation to the force of solar radiation; and apart from the smaller amount of the total annual precipitation summer savanna rainfall is equivalent to "monsoon" rainfall.

ON THE USE OF "AVERAGE," "MEAN," "GENERAL."<sup>1</sup>

By HUGH R. MILL, London.

In considering the distribution of rainfall \* \* \* we need to use terms with a definite meaning, and I hope that I may be excused for assigning definite meanings to familiar English words instead of importing classical terms which, despite a grander display of syllables, can mean no more. For convenience I use the term *mean* as indicating the sum of any number of figures divided by that number, reserving the word *average* for the mean of a number of figures representing values in order of time. Thus the mean of 30 annual rainfall values is spoken of as the average rainfall for 30 years. The mean of a number of uniformly distributed figures representing the distribution of rainfall in space I speak of as the *general* rainfall of the area concerned; thus the mean depth of rainfall over England for any day, month, or year is the *general rainfall* of England for that particular day, month, or year. The mean of the general rainfall of England for 30 years is expressed as the *average general rainfall* of England for 30 years. A line passing through points having the same rainfall is an isohyetal line, or *isohyet*—the term having been already introduced is retained on account of its similarity to isotherm and isobar. The line joining successive positions of the center of an atmospheric depression or cyclone is the *track* of the depression. The isohyetal lines representing the distribution of rainfall in a shower may be termed the *splash* of the rainfall, and the isohyets representing the rainfall of one or several days for a considerable stretch of country along the track of a depression, which is the generalization of a succession of splashes, may be called the *smear* of the rainfall of that depression.

## TEMPERATURE AND SPRING WHEAT IN THE DAKOTAS.

By THOMAS A. BLAIR, Observer.

[Dated, Weather Bureau, Wagon Wheel Gap, Colo., Jan. 8, 1915.]

In a previous article (1) a short study was made of the relation between rainfall and the yield of wheat in the great northwestern spring-wheat region comprising the States of Minnesota, North Dakota, and South Dakota; and the conclusion reached that the total precipitation of May and June, without regard to its distribution, is, in most years, the most important factor in determining the yield in the two Dakotas, but not in Minnesota. At the same time, attention was called to the fact that there is an evident relation between temperature and yield. A further study of this relation leads me to modify the above conclusion so far as to state that the mean temperature of June exercises an equally important influence on the yield in the Dakotas.

<sup>2</sup> Wallis, B. C., op. cit., p. 356-363.

<sup>1</sup> Extracted from [H. R. MILL]. On mapping rainfall. *British Rainfall*, 1907. London, 1908. 47: 36-43.  
See also H. R. MILL. Map studies of rainfall. *Quart. jour. Royal metl. soc.*, London, No. 146, April, 1908, 34.

<sup>1</sup> Extracted from B. C. Wallis. Geographical aspects of climatological investigations. *Scott. geogr. mag.*, Edinburgh, July, 1914, 30: (365, 368-369).